

Title: **RECLOSABLE BAG**

FIELD OF THE INVENTION

This invention relates to the general field of containers, and more particularly to multi-purpose and specialty storage bags.

BACKGROUND OF THE INVENTION

Bags are universally used and recognized as convenient, versatile, lightweight, and low cost containers. Bags having recloseable openings are useful to provide better security for their contents and for storage purposes. Such bags also have the benefit of better protecting perishable or sensitive contents, or alternatively, protecting the environment from contamination by contents that are toxic or dangerous.

A common closeable bag configuration has two rectangular panes of plastic film joined along three sides, with an opening left on one side, usually the top. A reclosable opening or zipper can be constructed on the open side by forming an interlocking strip on opposing panes, for example, by tongue and groove portions. The bags may be conveniently closed by pinching the panes together, so the tongue snaps into the groove, and opened by prying the panes apart.

In some cases a slider is added to facilitate opening and closing of the bag. A slider is a separate, usually molded, plastic piece that fits over and around the edge of the panes forming the bag opening so that it can slide along the strip. The slider is usually configured to apply an inward pinching pressure to urge opposing panels to join or interlock, and also to include a separator or finger that traverses the bag opening. With this configuration, closing the bag involves pushing the slider in a closing direction, and opening the bag involves moving the slider along a reverse, opening direction.

In many applications such as storage of food, liquids, or biological waste, it is desirable to form an airtight or leakproof seal of the closed bag. However,

for bags having sliders, the separator or finger part of the slider usually traverses the opening, which prevents the formation of an airtight seal. In one attempted solution, Blythe, U.S. Pat. 6,526,632, shows a slider which lifts the separation member out of the bag opening by rotating the slider upwardly at the closed end. This device however is more complicated than the conventional slider, which adds cost, and also apparently depends on use of a customized counterpart fastener 12.

Another desirable feature, particularly for perishable contents, is the ability to remove residual air from the interior of the closed bag. A common practice by users of household storage bags, for example, is to first close the bag almost all the way, leaving a small portion open. The bag is then squeezed to vent the residual air out through the small opening, after which the user tries to quickly close the small opening before air can re-enter the bag. This informal method however is generally inconvenient and produces inconsistent results. It is also awkward, particularly for individuals with poor motor skills.

Some attempts have been made to construct a closeable bag with a built-in facility for air removal. For example, Minica, U.S. Pat. 6,045,264, shows a bag having an open top divided into a main opening and a smaller evacuation opening. The latter opening is configured to include a suction conduit for use in removing residual interior air. Strong, U.S. Pat. 5,839,582, shows a bag having a bow-shaped pump chamber with a suction port and a one-way valve. When the bag is closed, the pump chamber can be compressed to push air out through the one-way valve. Herrington, U.S. Pat. 4,532,652, shows an extending portion adhering to a hole in one of the film side panels. Squeezing the bag causes the extending portion to separate from the side panel, permitting air to escape through the hole. Thereafter, the extending portion returns to its position covering the hole, preventing further outflow of interior air.

All of these devices require modification to the standard storage bag, which increases cost. In addition, the bags shown do not use a slider, which may be due to the difficulty of forming an airtight seal with a slider.

SUMMARY OF THE INVENTION

What is desired is a reclosable bag which overcomes one or more of the problems associated with such prior art bags.

Preferably, the bag should be easy and convenient for the user to close. In particular, it would be preferable if the bag could be configured to make use of a slider, which facilitates a strong air tight seal and the opening and closing thereof. A strong seal better maintains the freshness of perishable contents, and better protects the environment from toxic contents. The bag will also preferably be configured so that after it is closed the user can conveniently remove residual air, gas, or fluids from the bag interior, or alternatively, fill the interior with gas or fluid without disturbing the air-tight seal.

To keep costs low, the bag will preferably be capable of manufacture by conventional production techniques, using standard materials and components. The bag will preferably be suitable for production as a general purpose storage bag or as a commercial container for drinks and other items. Another preferable feature would be for the bag's closeable opening characteristic to be changeable. In this way, instead of the usual configuration where one side of the slider opens the bag and the other side closes the bag, the bag opening could be made, for example, to stay closed on either side of the slider as the slider is moved. This feature could enable greater flexibility in producing closeable bags that more closely meet the needs of different applications. It would also be preferable for the bag to effectively hold liquids, and to have a feature that prevents inadvertent spilling.

Accordingly, there is provided a reclosable bag, comprising:

- (a) a bag portion defining a bag interior and a bag opening;
- (b) a means for opening and closing said bag opening, said means comprising:
 - (i) opposed interlocking features along said bag opening, said interlocking features being sized and shaped to form a seal when engaged; and

- (ii) a slider in said bag opening, between said opposed interlocking features, to engage and disengage said interlocking features as said slider moves, said slider being further configured to seal said bag opening when positioned at one end of said bag opening;
 - (c) a passageway in said slider, to provide access between said bag interior and an area outside of said bag; and
 - (d) a means for selectively opening and closing said passageway;
- wherein, upon moving said slider to said end of said bag opening and sealing said bag opening, access may be selectively provided between said bag interior and said area outside of said bag through said passageway.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made, by way of example only, to preferred embodiments of the invention as illustrated in the attached figures.

Figure 1 is a perspective view of the reclosable bag of the present invention with the slider in an intermediate position;

Figure 2 is a perspective view of the reclosable bag of Fig. 1, with the slider in a closed or sealed position;

Figure 3a is a cross-sectional view of the reclosable bag of Fig. 1, showing the bag in an non-interlocked position;

Figure 3b is the same view as Fig. 3a, showing the bag in an interlocked position;

Figure 4 is a cross-sectional view of the slider of the present invention installed in the bag;

Figure 5 is a perspective view of the slider of Fig. 1 showing hidden elements;

Figure 6 is a side view of the slider of Fig. 1, without a handle;

Figure 7a is a perspective, hidden view of the slider of the present invention showing the opening edge of the slider;

Figure **7b** is the slider of Fig. 7a rotated to show the other side of the slider;

Figure **7c** is the slider of Fig. 7a viewed from the front;

Figure **8a** is a perspective, hidden view of the slider of the present invention showing the closing edge of the slider;

Figure **8b** is the slider of Fig. 8a rotated to show the other side of the slider;

Figure **8c** is is the slider of Fig. 8a viewed from the front;

Figure **9a** is a front view of the closing edge of the slider of Fig. 9, with one side of the slider left blank;

Figure **9b** is the same view as Fig. 9a with the other side of the slider left blank;

Figure **10** is a perspective view of the bag of Fig. 1, showing a suction device in the slider passageway and contents in the bag interior;

Figure **11** is a perspective view of another embodiment of the reclosable bag of the present invention, showing a fixed element and a slider;

Figure **12** is a perspective view of another embodiment of the reclosable bag of the present invention, showing a round commercial drink package; and

Figure **13** is a perspective view of another embodiment of the reclosable bag of the present invention, showing a gusseted commercial drink package.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The closeable bag of the present invention is shown in Fig. 1, and is generally indicated with reference numeral 10. There is a bag portion 12 which defines a bag interior 14. The bag portion is generally sealed or closed along its edges except for a bag opening 16, which defines an unsealed section that can be selectively opened or closed. In Fig. 1 bag opening 16 is the top unsealed side of the bag between end 22 and end 24.

The closeable bag includes a means for selectively opening and closing the bag opening. The means for opening and closing generally comprises two

elements - opposed interlocking features 18 along the bag opening 16, and a slider 20. The slider 20 is positioned in the bag opening 16, between the opposed interlocking features 18, and is generally movable along at least a portion of their length. The slider 20 is further configured so that as it moves, it causes the portion of the opposed interlocking features 18 that it passes to engage or disengage.

In Fig. 1, the slider 20 is shown at an intermediate position between end 22 and end 24 of the bag opening 16. In this position the opposed interlocking features 18 are engaged for a closed portion 15 of the bag opening 16 between the end 22 and the slider 20, and are disengaged for an open portion 17 of the bag opening 16 between the slider 20 and the end 24. In Fig. 2, the closeable bag 10 is shown with the slider 20 moved all the way to the end 24. It can be seen that in this position the opposed interlocking features 18 are engaged along the complete length, from end 22 to end 24, of the bag opening 16. It can be appreciated that in this position of the slider 20, closed portion 15 is at a maximum length.

The closeable bag 10 is configured so that when the slider is in the position shown in Fig. 2, in which the interlocking features 18 are fully engaged and the bag opening 16 is completely closed, the bag 10 is generally sealed airtight. The invention also comprehends a passageway 26 to provide access between the bag interior 14 and an outside area 28 of the bag, and a means for selectively opening and closing the passageway. In Fig. 1, the passageway 26 is shown inside the slider 20. The bag of the present invention can accordingly selectively provide access, through the passageway 26, between the bag interior 14 and outside area 28 when the bag opening 16 is completely closed and the bag 10 is otherwise sealed airtight.

The bag portion 12 of the present invention comprehends any structure that provides the function of a container or a bag. More specifically, the bag portion 12 defines the bag interior 14, which is a space inside the bag with a capacity to receive various contents for deposit.

The bag opening 16 represents an area or space through which access may be obtained to the bag interior 14. Depending on the application, the bag contents may be deposited or retrieved through the bag opening 16. The bag opening 16 is preferably formed by an unsealed or unconnected seam of the material used to form the bag portion 12, but may also be formed by a cut, slit, incision, gap, hole, or other break anywhere on the surface of that material. The position of the bag opening 16 may accordingly be along an edge, interface, or seam of two or more pieces of the bag material, or along a top, bottom, side, diagonal, or other section of the material.

As shown in a preferred embodiment of Fig. 1, a simple bag portion 12 may be created by joining two rectangular panes of material along three of their four sides. Alternatively, the embodiment of Fig. 1 could also be made by folding a single sheet of material to form the two panes, and sealing the two sides. For convenient reference, the two panes may be designated as a front pane 30 and a back pane 32. In this embodiment the bag interior 14 is the volume of space between the two panes 30 and 32, and the bag opening 16 is the area bounded on its perimeter by the edges of the two panes on the unsealed top side of the bag.

The bag portion 12 also preferably includes a support feature 33 adjacent to the bag opening 16 on an exterior part of the bag. The support feature 33 may take the form, for example, of a ridge, ledge, bulge, or similar protrusion. In the bag of Fig. 1, support feature 33 is a thickening or bulging of the bag material along the edge of the top open side of each pane of the bag. As will be discussed in greater detail below, feature 33 provides a surface that facilitates support or attachment of the slider 20.

It can be appreciated that other embodiments of the bag portion 12 are possible as long as they define a bag interior 14 capable of holding contents, and a bag opening 16 to provide access to the bag interior. Some examples of alternative embodiments include a bag portion 12 formed from a single piece of spherical material having no panes or seams, as shown in Fig. 12, or a more

complex gusseted bag having six panes, as shown in Fig. 13. In these embodiments the bag opening 16 may be formed by an incision or cut in the material forming the bag portion 12.

The bag portion 12 is preferably formed from a material sufficiently dense to contain air, gas, liquid, or other fluid contents without leakage, and sufficiently strong to hold the expected contents without tearing. The material should preferably be water resistant so as not to lose structural strength from contact with liquids. For these reasons bags made of plastic or polyethylene have been found to be adequate. Depending on the application, other materials such as film, laminate, or coated or treated paper may also provide adequate results. The bag material is preferably smooth, but may also be made laminated. Laminations are sometimes preferable, particularly in larger bags, since they can provide channels for the movement of air flow inside the bag interior 14.

To retain the flexibility characteristic of bags the material should also preferably be pliant or elastic. The degree of flexibility in the material can be varied according to the application. However, it is preferable that there be at least sufficient flexibility so that the part of the bag portion 12 that defines the perimeter of the bag opening 16 can be pulled or drawn together by a user, to effectively close the bag opening 16.

The bag 10 of the present invention is generally configured to be closed or sealed everywhere on its surface and at all seams and edges except for bag opening 16, which can be selectively opened or closed. Therefore, closing bag opening 16 has the effect of completely enclosing bag interior 14 and closing the bag 10. The bag 10 may be designated alternately as "closeable" or "recloseable", in each case meaning that the bag can be repeatedly opened and closed.

In Fig. 1 the bag opening 16 is formed in the space between the top edges of the unsealed sides of opposed panes 30 and 32. Interlocking features 18 are installed on the inner part of the opposed panes 30 and 32 that form the

perimeter of bag opening 16. The interlocking features 18 may be more particularly referenced as interlocking or front feature 34 on front pane 30 (not visible in Fig. 1) and interlocking or back feature 36 on back pane 32. The interlocking features 18 are positioned to oppose one another and are sized and shaped to engage and close bag opening 16 when panes 30 and 32 are brought together.

In the preferred embodiment of Fig. 1 the position of the interlocking features 18 is at the top inner edge of panes 30 and 32. This positioning is preferred because it maximizes the interior space 14 of the bag 10. However it can be appreciated that the interlocking features 18 may be placed anywhere on the bag 10 and oriented in any direction as long as it forms an opposed pair sized and shaped to close bag opening 16 when engaged.

The interlocking features 18 represent any configuration which will enable the opposed panes of the bag portion 12 to engage when the panes are brought together or in close proximity, to close bag opening 16, and also comprehend any configuration which will enable the engaged panes to disengage when the panes are drawn or pulled apart, to re-open bag opening 16. The interlocking features 18 should preferably be sufficiently robust in design and composition to enable repeated opening and closing within the expected lifespan of the bag 10 without experiencing undue loss in the strength of the engaged portions. In addition, the interlocking features are preferably sized and shaped to form a seal when engaged. In this way, fluid contents in the bag interior 14, for example, would not leak out of the bag through the engaged interlocking features.

A preferred type of interlocking feature 18 comprises mechanical elements which interlock through an interference or snap fit, such as by one feature sliding, pressing, or snapping inside the other feature. Such an arrangement is commonly described as a "tongue and groove" or "male and female" configuration, with the inner piece being the tongue or male portion and the outer piece being the groove or female portion. Figure 3 shows a

cross-sectional view of a preferred embodiment of the interlocking features 18. In Fig. 3a there is a male or tongue feature 34 and a female or groove feature 36. In this figure the opposing interlocking features are not connected or engaged, so that bag opening 16 is open. In Fig. 3b the features 34 and 36 are engaged in that tongue feature 34 is inserted into groove feature 36 by a snap fit. The features 34 and 36 are preferably formed from the same plastic material as the panes 30 and 32, and are sized and shaped so that tongue 34 fits snugly inside groove 36. The combination of the close fit and resiliency of the material cause the engaged pair to form an effective seal, and to resist disengagement unless a minimum sufficient force is applied to opposed panes 30 and 32 to pull them apart. It can be appreciated that the larger the tongue feature 34 is relative to the groove feature 36, the harder it will be to snap fit the features together, but the stronger will be the connection and the tighter will be the seal.

The preferred arrangement shown in Fig. 3 has been found to be generally adequate, particularly for low cost applications, as it provides adequate performance and can be produced at low cost. However, it can be appreciated that other types of interlocking features 18 are comprehended by the present invention as long as they retain the properties of being able to engage or disengage without too much difficulty, maintain a minimum sufficient strength of engagement, and retain this strength of engagement after repeated openings and closings. Other possible embodiments may include, for example, magnetic means of engaging or disengaging opposing panes.

The slider 20 is preferably an independent piece or element separate from the bag portion 12. Figures 5-9 show various views of a preferred embodiment of the slider 20, where for enhanced clarity the independent slider element is shown isolated, or unconnected to the bag portion 12.

With reference to Fig. 5, the slider 20 generally comprises a central or core body 38 with projecting handles 40 on either side. The body 38 has a top 42, a bottom 44, and a pair of sides or side faces 46, which for clarity are further

distinguished as side face 45 and side face 47. The side faces 46 comprise the part of the slider 20 that face or make contact with the opposed interlocking features 18 of the bag 12.

It can be seen through the hidden view of Fig. 5 that the core body 38 is widest at the center and tapers to opposing tips, ends, or edges 48, 50. Each of the edges 48 and 50 extend the length from the top 42 to bottom 44 of the core body 38. The slider 20 is also preferably sized and shaped to be complementary to the shape of an end of the bag opening, to permit the slider to form a better seal. As a result of this preferred configuration, in a top view the body 38 resembles a flattened oval terminating in a point at each end. This aspect of the slider 20 may also be seen in Figs. 1 and 2 which show, in hidden lines, the upper edges of panels 30 and 32 in bag opening 16 wrapping around the oval-shaped core body 38 of slider 20.

The handles 40 provide support to keep the slider 20 in place or attached to the bag 12, and also provide a handle, grip, or contact for the user to hold when moving the slider. The handles 40 preferably attach to or extend from the slider body 38 at or near the top 42, and extend outwards to either side and downwards towards bottom 44 to some extent. It is also preferable for the bottom of the handle to extend inwards towards the body 38, to create a support ledge 52. In Fig. 5 the handles 40 include an outward panel 53, downward panel 54, and inward panel 55. However it can be appreciated that handles 40 formed from a single curved panel, for example, would also be adequate. In another embodiment that provides greater surface area, the handles 40 could rise vertically above top 42 of the slider body before turning outwards and downwards.

It can be appreciated that the handles 40 include both an inside portion that faces the sides 46 of the slider and an outside portion that faces away from the sides 46 of the slider. The outside portion provides a surface which may be grasped by a user to hold or move the slider 20. Accordingly, the handles 40 and in particular the outside portion of handles 40 are preferably sized and

shaped to provide a comfortable and secure gripping surface. This may include, for example, in panel 54, an indentation in the surface or the use of a rubber material with nodules to provide a more effective grip.

The handles 40 are also preferably sized and shaped so that the inside portion generally follows the contour of the sides 46 of the slider. In the preferred embodiment of Fig. 5, the inside portion of the handles 40 will accordingly follow the oval contour of the core body 38, which expands outwards from ends 48 and 50 towards the center of the body. As can be seen in the drawings, the handles 40 and their inside portion extend all the way towards end 48 of the slider body 38, but stop short from end 50. The reason for this configuration relates to different functions served by ends 48 and 50, and is discussed in greater detail below.

The slider 20 is also preferably configured so that the separation or gap distance between the sides 46 of the body 38 and the inside portion of the handles 40 will be approximately the thickness of the individual panels 30 and 32, along the bag opening 16, of the bag portion 12. More preferably, the separation or gap distance will be slightly greater than the bag panel thickness, so that there will be sufficient space for the bag panels to be inserted and fit between the slider body 38 and handles 40, while maintaining a close and secure connection.

Figures 7 and 8 provide enhanced views of the side faces 46 of the slider 20. For greater clarity, in these figures the handles 40 are shown in outline so that the slider body 38 and sides 46 can be more clearly viewed. It can be seen that each of the individual side faces 45 and 47 have a side rail 56, or more particularly side rail 58 on side face 45 and side rail 60 on side face 47. The side rails 56 are sized and shaped to mate with or slidably engage an opposing interlocking feature 18 on the bag portion 12, and accordingly are preferably configured as a tongue or a groove. It can be seen from Figs. 7a and 8b that side rail 58 comprises a tongue or male connector, and from Figs. 7b and 8a that side rail 60 comprises a groove or female connector.

The side rails 56 are preferably positioned in the middle of the body 38, equidistant from the top 42 and bottom 44. The side rails 56 are also preferably formed by carving the desired feature, whether tongue or groove, out of the side 46 so that side 46 maintains a flat or flush profile.

The side rails 56 generally extend the length of the sides 46, but vary in configuration according to which end, 48 or 50, is being approached. End or edge 50 is highlighted in Fig. 7, with Fig. 7a providing a perspective view of side 45 and tongue side rail 58, Fig. 7b providing a perspective view of side 47 and groove side rail 60, and Fig. 7c providing a front view of both sides and side rails. It can be seen that the side rails 56 terminate just before edge 50, and do not interact, abut, or otherwise contact one another. Edge 50 in effect separates the side rails 56, and accordingly maintains a generally continuous, unbroken line from top 42 to bottom 44 of the slider body 38.

Similarly, end or edge 48 is highlighted in Fig. 8, with Fig. 8a providing a perspective view of side 47 and groove side rail 60, Fig. 8b providing a perspective view of side 45 and tongue side rail 58, and Fig. 8c providing a front view of both sides and side rails. In this case the side rails 56 intersect, producing a hollowed out section 62 where they meet along edge 48.

Figure 9 has been provided to enhance clarity of the configuration of edge 48. In Fig. 9a groove side rail 60 is shown but side 45 has been left blank, without side rail 58, for illustration purposes. It can be seen that the groove 60 extends all the way to the edge 48 and wraps around it so that the groove carves out a small portion of side 45. Similarly, in Fig. 9b tongue side rail 58 is shown with side 47 left blank. In this case the tongue 58 also extends all the way to edge 48 and wraps around it, thereby extending into side 47. When the two side rails of Fig. 9 combine, the result is the hollowed out section 62 along edge 48 shown in the various views of Fig. 8.

Figure 6 is a side or profile view of the slider body 38, taken along side 47 and showing groove side rail 60. It can be seen that edge 50 remains continuous and unbroken, as side rail 60 and side rail 58 (not shown) both

terminate just before the edge. By contrast, side rail 60 extends all the way to edge 48 and wraps around it, along with side rail 58 (not shown) creating hollowed out section 62. As will be discussed in more detail below, the configuration of side rails at edge 50 has the effect of disengaging the opposed interlocking features 18, while the configuration at edge 48 engages the interlocking features 18. For this reason, the slider ends may alternatively be designated as opening or separating edge 50 and closing or joining edge 48.

Opening edge 50 can be made to form a straight vertical edge. However, as shown in Fig. 6 and Figs. 7a and 7b, edge 50 is preferably configured to include a projection or jutting portion 64 at one or more places along its length. The projection portion 64 is sized and shaped to make slider 20 form a closer, more complementary fit with the end of bag opening 16. In this way, a more effective seal will be created when the slider is moved to an end of bag opening 16, as shown in Fig. 2.

Slider 20 also preferably includes the passageway 26, which is an aperture or hole extending the full height of the slider from top 42 to bottom 44. Figure 5 shows the slider 20 with the hidden part of passageway 26 shown in dotted line. The passageway can have any cross-sectional shape, such as circular, oval, or rectangular, but is preferably circular. It can be located anywhere on the slider, but preferably is located at or close to the center or midpoint of the slider. The passageway 26 can be any size in diameter or width as long as it does not interfere with the structural integrity of the slider. The passageway is also preferably sized and shaped to permit gas, fluid, or solid matter to flow or pass through its interior, and to accept a fluid transmission conduit, as discussed further below.

The slider 20 is preferably made from a polyethylene or plastic material. Plastic is preferred because it is relatively strong, lightweight, water resistant, and low cost. A further advantage of plastic is that it can be made relatively easily into a complex shape like the slider 20. This can be accomplished, for example, through the standard production technique of injection molding, using

a standard mold designed to conform to the shape of the slider 20. Plastic is also a preferable slider material to use when the bag portion 12 is plastic, so that the various components can be more easily integrated. It can be appreciated that other materials are also comprehended by the present invention as long as they possess some or all of the above properties. Other possible materials for the slider may include, for example, metal, alloy, or wood.

In forming the bag 10 of the present invention, the body 38 of the slider 20 is placed inside the bag opening 16 so that sides 46 are positioned between the opposed faces of front feature 34 and back feature 36. As shown in Fig. 4 in cross-sectional view, the slider 20 attaches to the bag portion 12 on both the inside and the outside of the bag.

On the inside of the bag, the side rails 56 of the slider mate or slidably engage with the opposed interlocking features 18 of the bag portion 12. With respect to the embodiment of Fig. 4, the tongue of front feature 34 snaps or fits inside the groove of side rail 58, and the tongue of side rail 60 snaps or fits inside the groove of back feature 36. It can be appreciated that other embodiments of these interacting elements are also possible, as long as the slider slidably engages with the bag portion 12. For example, the interlocking features 18 could be made flush with the bag portion 12, with the side rails 58 and 60 projecting outwards from the sides of the slider.

On the outside of the bag, it can be seen that the handles 40 of the slider are sized and shaped to conform to or snugly fit with the external support feature 33 of the bag portion 12. In particular, the handles 40 wrap around support feature 33 so that the bottom of support feature 33 rests on support ledge 52 of the handles 40. It can be appreciated that other embodiments of these elements are also possible as long as the handles provide a means for securing the slider to the outside of the bag portion 12. For example, the particular shapes of the support feature 33 and handles 40 can vary as long as they continue to conform to one another to form a close, snug fit. Similarly, other types of attachment besides a mechanical fit are also possible, such as

for example, a magnetic connection between the inside of the handles 40 and the opposing external edge of the bag portion 12 or support feature 33.

It can be appreciated that the combination of the interlocking elements inside the bag and the close fit of the handle around the external support feature 33 closely hold the slider 20 to the bag portion 12. In particular, the slider 20 is attached so that it cannot fall into the bag interior 14 or inadvertently pop out of the open top. Short of a determined and forceful effort, the slider 20 will resist most attempts to be separated or removed from the bag portion 12.

The slider 20 is sized and shaped to engage the interlocking features 18, or alternatively, to disengage the interlocking features 18, as the slider is moved along the bag opening 16. More specifically, the configuration of edges 48 and 50 of the slider 20 determine whether a given portion of bag opening 16 will engage or disengage as the slider moves in a particular direction.

Turning to the preferred embodiment of the closeable bag 10 shown in Fig. 1, it can be seen that from an intermediate position the slider 20 can be moved in two directions, towards either end 22 or end 24. In whichever direction the slider is moved, one of the slider edges 48 or 50 will face the end in the direction of movement, and the other one will trail, facing the opposite end. The bag 10 of the present invention is configured so that as the slider is moved along a portion of bag opening 16, the interlocking features 18 in the portion covered by the slider movement will join or engage, or alternatively, separate or disengage, in accordance with the characteristic of the trailing end or edge of the slider 20.

More particularly, in Fig. 1 the slider 20 is oriented so that joining edge 48 faces end 22 of the bag 10, or closed portion 15 of the bag opening 16, and separating edge 50 faces end 24 of the bag, or open portion 17 of the bag opening 16. As slider 20 is moved towards end 24, the interlocking features 18 will join, close, engage, or interlock in accordance with trailing joining edge 48. In this way, closed portion 15 will increase in length commensurate with open portion 17 decreasing in length. As shown in Fig. 2, when the slider reaches

end 24 the entire length of interlocking features 18 will be closed. Similarly, as slider 20 moves towards end 22, as for example in moving from the position in Fig. 2 to the position in Fig. 1, the interlocking features 18 will separate, open, or disengage, in accordance with trailing separating edge 50.

The joining and separating function of the slider 20 can be understood by tracing the path of the interlocking features 18 through edges 48 and 50 of slider 20. As shown in Fig. 4, the interlocking features are slidably engaged with side rails 56 over most of the length of sides 46 of the slider. As the slider of Fig. 1 moves towards end 24, the portion of the interlocking features that pass through trailing edge 48 will be drawn together due to the continuation of the side rails right up to and around the edge 48. As each side rail wraps around the opposite side at edge 48, the slidably engaged tongue and groove features 34 and 36 will be forced into contact, with tongue 34 snapping or pressing into groove 36. Further, the inner portion of handle 40 follows the contour of sides 46 all the way to edge 48. Since the gap or separation distance between the inner portion of the handle 40 and sides 46 is very small, and preferably only marginally thicker than the thickness of the upper edges of individual panes 30 and 32, the panes 30 and 32 will be forced to stay in the track of side rails 56 and forced to come together. In this way, the interlocking features 18 make a smooth transition from being slidably engaged with side rails 46 of the slider, as for example shown at 65 and 66 of Fig. 1, to being interlocked with one another, as shown in their corresponding positions on the closed portion 15 of Fig. 2.

Conversely, when the slider 20 moves towards end 22, the portion of the opposing features 34 and 36 that pass through trailing edge 50 will be unable to engage due to the termination of the side rails 56 on either side of separating edge 50. Further, the inner portion of handle 40 only follows the contour of sides 46 to a point short of separating edge 50. There is no need for the inner portion of handle 40 to extend all the way since it is not desired to press the interlocking features together at separating edge 50. As a result, while the

opposing features 34 and 36 will approach one another as the contour of slider 20 narrows towards edge 50, as they slip off the side rails 56 they will remain apart since there is no guide or track on the slider side rails or outside pressure from the handles 40 to keep them together.

It can be appreciated that other open/close characteristics of the closeable bag 10 can be achieved by modifying the construction of the slider 20. For example, instead of having both a joining edge 48 and a separating edge 50, the slider 20 could be made with two joining edges 48. In this case the bag opening 16 would remain closed for its entire length, on both sides of the slider, for any position of the slider. Alternatively, if the slider is constructed with two separating edges 50, no part of the bag opening 16 would close.

The closeable bag 10 is configured to produce an airtight seal in the bag interior 14 when the bag opening 16 is fully closed. As shown in Fig. 2, this will occur where the slider 20 is moved to the sealed position at end 24.

The interlocking features of the present invention are preferably sized and shaped to form a seal when engaged. In particular, the tongue feature 34 and groove feature 36 are preferably sized and shaped to form an airtight seal when they interlock or snap-fit together. Accordingly, with the slider 20 in the position shown in Fig. 2, the closed portion 15 of bag opening 16 from end 22 to end 48 of the slider will be airtight due to the engagement of interlocking features 18.

The slider 20 is configured to seal the bag opening 16 when positioned at one end of said bag opening. Slider 20 is accordingly preferably configured to produce a seal all around its perimeter. At the point where closed portion 15 meets joining edge 48, the interlocking features 18 are squeezed closely together, both from the inward pressure of the close-fitting handles, and to connect with side rails 56. In this way the airtight seal is maintained at the interface of the interlocking features 18 and the slider. Along the sides 46 of the slider the airtight seal is maintained due to the snap fit between side rails 56 and interlocking features 18. Accordingly, side rails 56 are preferably sized

and shaped to produce an airtight fit or engagement with interlocking features 18. At the interface of separating edge 50 and end 24 of the bag 10, the airtight seal is achieved by configuring the slider 20, and in particular separating edge 50, so that it is complementary to the shape of bag opening 16 at end 24. In the preferred embodiment of the bag 10, the edge 50 of the slider has a "V" shape which complements and fits closely into a similar "V" shape in bag opening 16 at end 24. Separating edge 50 preferably also includes the projection or jutting portion 64. As shown in the side view of Fig. 6, this feature assists in maintaining an airtight seal by jutting out from the slider to fill any incremental space that may be present in bag opening 16, at end 24, through which air might leak.

It can be appreciated that other shapes of the slider 20 and bag portions 12 may also be used, as long as the shapes of the slider tip and end of bag opening 16 are sufficiently complementary to form a close and snug fit. It can also be appreciated how the present invention improves on the prior art. Sliders used in the past usually contain a separator or finger to separate or pry apart the panes. The separator is usually configured to fulfill this function, and not to form a complementary fit with a bag opening. Such sliders cannot usually seal a bag opening in the ordinary course since the separator prevents the slider from completely closing the bag opening.

In order to maintain the airtight seal once the slider has reached the end 24, it is preferable for there to be a latch or other means to hold the slider 20 in place and prevent it from falling back. This may be achieved in the present invention by means of a detent, which is a catch or lever that locks the movement of one part of a mechanism. Detents can be placed anywhere along the slider 20 or the bag portion 12.

In the preferred embodiment of Fig. 1, the bag portion 12 contains a first detent 68, and the slider 20 contains a second detent 70 on the inside of handle 40. The first detent 68 and the second detent 70 are configured to engage one another when the slider is moved to the sealed position. The first detent 68 is

preferably a bump or raised nodule on the outside surface of the bag portion 12, such as on external support feature 33. The second detent 70 is preferably an indentation on the inside of handle 40. When the slider 20 is moved to the sealed position, the detent 68 snaps into or engages with detent 70. The connection established is preferably sufficiently strong to hold the slider 20 in place, while at the same time capable of being overcome without too much difficulty by the user pushing the slider towards end 22 when it is desired to re-open the bag.

It can be appreciated that other embodiments for latching of the slider are possible, as long as the slider 20 is prevented from falling back and a good seal is maintained. For example, Fig. 10 shows the slider 20 having a flap 72 resting on the top 42 of the slider. At the sealed position shown in Fig. 10, the flap may be moved, rotated, or otherwise positioned to snap fit with a detent (not shown) on the outside edge of the bag portion 12. When it is desired to move the slider, the flap 72 can be flipped up and out of the way, to restore mobility to the slider.

The passageway 26 is configured to provide access between the bag interior 14 and outside area 28 whether the bag opening 16 is open or closed. In the preferred embodiment of the invention, passageway 26 is preferably inside or integrated with slider 20. Since the slider is positioned between interlocking features 18, it can be appreciated that access between bag interior 14 and outside area 28 through passageway 26 will be unaffected even when the bag opening 16 is closed and sealed airtight.

The passageway 26 is sized and shaped to provide access to passage of a fluid, such as a gas or a liquid, or solid matter such as particulates or powder.

The passageway 26 is also preferably sized and shaped to accept a fluid transmission conduit 74 such as a pipe, tube, or common straw. A general representation of a tube 74 is shown in Fig. 10. Such a device when coupled to the passageway from outside 28 of the bag would permit the application of suction, for example, to remove fluid from bag interior 14 through the

passageway 26. More particularly, a suction device having a coupling or insertion end 76 and a free end 78 may be coupled to the passageway 26 on the top surface 42 of the slider. Suction may be applied at the free end 78 to remove contents such as liquid or gas fluid from the bag interior 14. In an industrial setting the suction will preferably be applied by a mechanical vacuum device. In a consumer product suction will preferably be applied by the user's mouth acting on the free end 78 of a straw. Preferably, the fluid transmission conduit 74 will be removable, and the passageway 26 will accordingly be sized and shaped to couple and uncouple with the removable conduit 74. In this way, after the fluid is removed from bag interior 14 the tube 74 may be conveniently removed so it does not interfere with use of the bag 10 as a storage container.

The passageway 26 preferably contains a means for opening and closing the passageway, or valve 80, as shown in Fig. 5. The valve 80 is any kind of device or structure that is positioned inside the passageway 26, and that is sized, shaped, and configured to have at least one closed state and at least one open state. When the valve 80 is in its closed state, fluid flow through the passageway 26 will be blocked. In this state, if the bag opening 16 is completely closed, there will be an airtight seal of bag interior 14. When the valve 80 is in an open state, access or fluid flow between the bag interior 14 and outside 28 of the bag will be enabled. It can be appreciated that when the valve 80 is in an open state and the bag opening 16 is completely closed, access to the bag interior 14 will be available only through passageway 26 and valve 80.

The valve 80 will preferably be a one-way valve, meaning that when the valve is in an open state fluid will be permitted to flow in one direction only. For example, the one-way valve could be configured to permit access or fluid flow from the bag interior 14 out of the bag to outside 28, and to block fluid passing from the outside 28 to the bag interior 14. This type of valve would be useful for removing air from a bag used to store food or other perishable contents, for example. Alternatively, the one-way valve could be configured to permit access

or fluid to flow in the other direction only, from the outside 28 of the bag into the bag interior 14, and to block fluid from passing from the bag interior 14 to the outside 28. This type of valve would be useful for an application in which it is desired to inject into the bag a special gas or liquid that preserves or protects the bag contents, such as for example, using formaldehyde to preserve a biological specimen.

The bag 10 of the present invention comprehends the use of almost any type of valve 80 to achieve a desired flow characteristic through the passageway 26. For example, the valve 80 could be a two-way type instead of one-way. A two-way valve is a valve having two open states, in which one state permits flow in one direction and the other state permits fluid flow in the other direction. Activation of a particular state might arise simply from use of the valve. For example, squeezing the bag 10 might force air out of the bag interior 14, through the valve 80 towards the outside 28 of the bag. Alternatively, a tube could be coupled to the passageway 26 containing the same valve and pressure applied to force a liquid into the bag. In this state, the valve would permit fluid flow in the opposite direction from the first use, from the outside 28 to the bag interior 14. Alternatively, the two-way valve 80 could be configured so that the permitted direction of flow is set through a switch on the valve itself, or preferably, on the surface of the slider 20.

The valve 80 may be configured so that when it is in an open state the passageway 26 will be substantially or completely open, so that fluid passing through the passageway will be able to flow at an optimum high rate. Alternatively, the valve 80 may be configured to partially close the passageway 26 to any degree desired.

It can be appreciated that valves are generally configured for installation in a passageway or tube located inside a solid body. Therefore, many types of standard valves are similarly amenable for installation in the passageway 26 of the present invention, since the passageway 26 is preferably located inside the solid body of the slider 20. A common type of valve suitable for use in the

passageway 26 of the present invention is a ball valve, which is generally represented as valve 80 in Fig. 5. As pressure is applied to a ball valve, such as by suction through conduit 74, the ball will rise and open the passageway 26. Another type of valve 80 may be a pinching valve, which would provide access through the passageway upon squeezing or pinching the slider. Similarly, many other types of valves common in industrial and consumer applications may also be used in the present invention. In addition to a ball valve or pinching valve, the valve 80 may be a flapper valve, air valve, or check valve, for example.

The present invention comprehends use of the slider 20 without an integral passageway 26. It can be appreciated that since the slider 20 is configured to open and close the bag opening 16, and to form an airtight seal when in a completely closed position, a bag 10 made with the slider 20 may be useful even without the passageway 26. For example, the bag 10 could be filled with a liquid and the slider closed to form an airtight seal, preventing leakage of the liquid. When the liquid contents are to be used, the slider could be pushed open slightly and the liquid poured out. Such a bag 10 would have the advantage of being easy to open and close, due to the slider 20, and also provide the benefit of an airtight seal to better preserve perishable contents or hold liquids.

The present invention also comprehends separating the passageway 26 from the slider 20. Such an arrangement is preferably realized using an access element 82 to contain or integrate with the passageway 26. The access element 82 is generally a body positioned between two edges or panes of the bag 10, and that contains the passageway 26 and valve 80. The access element 82 may be sized and shaped similar to slider 20, or it may have any other size and shape as long as it can be positioned between two edges of the bag 10. The access element 82 is preferably fixed in position. This may be accomplished, for example, by sealing the panes 30 and 32 around the sides of the access element 82.

In one embodiment, the two edges of the bag 10 may be two edges of opposed panels 30 and 32 that define bag opening 16. In that case, the sides of access element 82 could be sealed between opposing panes 30 and 32 in a variety of ways known in the art. The bag 10 might also be made without interlocking features 18 around access element 82, since the features 18 would not be needed to support slider movement in that portion of bag opening 16. This embodiment is illustrated in Fig. 11, which shows the movable slider 20 without passageway 26, and the access element 82 having the passageway 26 and a removable tube or straw 74.

It can be appreciated that where the access element 82 is fixed, the use of the passageway 26 to access the bag interior 14 will not be affected by the particular positioning of access element 82 in the bag 10. Accordingly, in a further embodiment the two edges of bag 10 could be two edges of opposed panels 30 and 32 that do not define bag opening 16. This would generally comprise the perimeter of the bag 10 other than that portion occupied by bag opening 16. In Fig. 11, for example, the two edges between which access element 82 could be placed could be the edges of panels 30 and 32 along closed sides 84 and 86 of bag 10.

In this embodiment it is preferable that access element 82 be located between opposing panes or edges of the bag 10 that are joined, welded, or seamed together. Such an arrangement simplifies manufacturing of the bag 10, since the access element 82 could be placed between the panels, which would wrap around the access element. The panels would be welded or sealed together as before, with the access element 82 sealed between them. Where the two opposing panels are joined by a fold, installation of the access element would be less convenient since a hole would need to be made. For example, if the bag 10 in Fig. 11 were formed from a single panel folded along bottom side 88, it would be less convenient to install the access element on side 88. If the bag were formed from separate panels 30 and 32 that were welded or

joined together along all edges, then it would be equally convenient to install the access element 82 along any of sides 84, 86, or 88.

The preferred embodiment of the present invention can now be understood as the case where access element 82 is the slider 20. This embodiment is preferred since a bag having only one body, comprising a slider with an integrated passageway, is generally less costly and more efficient to produce and use than a bag having two bodies comprising an access element and slider.

A common type of bag production involves joining two rectangular panes along three sides, or along opposing sides of a single folded pane, leaving a bag opening 16 open on one side. A slider may be inserted in the bag opening 16 during production so that it is movable along the bag opening 16 without being removable from the bag itself. The standard production equipment also generally operates at a high cycle or production rate, which results in lower cost.

The bag portion 12 of the bag 10 of the present invention similarly can be made from one or two panes of plastic joined along two or three sides, leaving a bag opening 16. The interlocking features 18 along the bag opening 16 can similarly be produced using standard production techniques. The slider 20 of the present invention is configured as an independent body capable of production by standard injection moulding techniques. Therefore, while the slider 20 is different from the prior art sliders in form and function, it can still be manufactured at a similar low cost. Moreover, the standard production equipment for producing bags and installing sliders can be used to produce the bags 10 of the present invention. In production, movable sliders 20 would be laid down in the bag opening 16, and separate access elements 82 would be installed, if desired, either in the bag opening 16 or along a joint or seam between panes prior to the panes being sealed.

It can be appreciated therefore that the bag 10 of the present invention can be produced for about the same low cost or competitive with conventional slider bags that lack the other benefits of the present invention. The material

costs for the bag and slider are similar to conventional bags, and the production equipment is the same or usable with only slight modification. Moreover, since standard production equipment may be used, the industry standard high cycle rates of such equipment may continue to be applicable. It can be further appreciated that this represents an improvement over the prior art. Since prior art devices generally require unconventional bags and valves, both the bag and valve materials and production equipment generally are non-standard and need to be custom made. Further, cycle rates are likely to be lower, which increases the cost of each bag.

The operation of the present invention can now be described, using as an example the reclosable bag 10 configured as a household storage bag as shown in Fig. 10. The user will likely begin use by moving the slider 20 to end 22, to open bag opening 16. The user will deposit a perishable food item 90 into the bag interior 14, and then close the bag by moving slider 20 to the closed or sealed position at end 24. Where the slider 20 uses detents 68, 70 as in Figs. 1 and 2, the user will be able to gauge how far to move the slider by sensing or hearing the detents click or snap into position, thereby engaging the slider at the second end 24. Alternatively, where the slider incorporates latch 72 as shown in Fig. 10, the user will lock the slider in place by rotating the latch to a down position and snapping it in place.

At this point the bag will be sealed airtight, but may contain residual air in the bag interior 14. The user can then exchange air or fluid between the bag interior 14 and the outside 28 of the bag through the passageway 26 in the recloseable bag opening 16. The removal of air or fluid from the bag interior 14 may be achieved, for example, by inserting the insertion end 76 of the hollow tube 74 into the passageway 26 and applying suction to the free end 78. In a consumer application, the hollow tube 74 will preferably be a straw and the suction applied by the user's mouth. The valve 80 in this example will preferably be a one-way valve permitting fluid to flow in the direction from the bag interior 14 to the outside 28. Upon removal of all or substantially all of the

air in the bag interior 14, the tube 74 may be removed from the passageway 26, and the bag 10 placed in storage. In another embodiment, instead of using a hollow tube 74, the bag 10 may be squeezed to force residual air out of the bag interior 14 through passageway 26. This method could also be performed with the embodiment shown in Fig. 11 having a slider and access element 82.

It can be appreciated that the method of closing a bag of the present invention represents an improvement over the prior art. In the prior art the user would ordinarily close the slider close to end 24, leaving a small opening 17. The bag would be squeezed to force residual air out through opening 17. Then, the user would close the slider with one hand while usually keeping the other hand pressed against the bag, to prevent the inflow of air during the period that the slider is being closed. Further, once the bag is closed, there is unlikely to be an airtight seal due to the presence of the separator or finger of the conventional slider in the bag opening. By contrast, in the present invention the user can force air out of the bag, by squeezing the bag, applying suction to hollow tube 74, or otherwise, and not be concerned about the possible inflow of air because any such air will be blocked by the valve 80. It can accordingly be appreciated that the method of closing a bag of the present invention is easier and more convenient than the conventional method, and further produces a more air free bag interior 14.

In another application of the present invention, the passageway 26 could be fitted with a valve 80 that permits fluid flow into the bag interior 14, while blocking flow in the opposite direction. Such a bag could be used in an industrial setting to receive a drinkable fluid or other fluid for commercial sale. For example, where the contents are a drinkable fluid the valve 80 could be made two-way, so the user could use a straw to retrieve the contents. Alternatively, a two body configuration as shown in Fig. 11 may be used, where the slider 20 has a passageway 26 with a valve permitting fluid flow in one direction, and the access element 82 has a passageway 26 with a valve permitting fluid flow in the other direction. In that case, one passageway would

be used to fill the bag, and the other used to remove or drink the contents. For a non-drinkable type of fluid, the slider may be pushed open a short distance to permit the user to pour out the contents.

It can be appreciated that a variety of commercial bag configurations are made possible by the present invention. In particular, the parameters available to a designer of a bag 10 of the present invention include: the choice of which edges 48 and 50 to use for the slider, whether to use a single slider 20 or an additional access element 82 with one or two passageways between them, selection of the type of valve 80, and also whether to seal all or a portion of interlocking features 18. In addition, the designer can select a variety of bag shapes in addition to the standard two pane configuration.

For example, Figs. 12 and 13 show embodiments of bags 10 suitable for use as commercial drink containers. Fig. 12 is a round container and Fig. 13 is a rectangular container having gussets on either end. The round container has the advantage of being inexpensive, providing optimally large internal volume for the amount of material used, and also optimizing shipping capacity because adjacent bags will compress against each other to leave very little unused space.

The bag portions 12 may be produced using standard equipment for the types of bags shown in Figs. 12 and 13. The bag opening 16 may be formed from a slit or cut in the bag surface, and the slider 20 installed using standard equipment. In a variation on the embodiments shown, the bag opening 16 could be made much shorter, or most of the length of the bag opening 16 could be sealed. The slider could be movable along a short distance, perhaps a distance approximately equal to its length. In production, the slider could be positioned to leave a small opening 17, and a nozzle inserted into opening 17 to fill the containers. The slider could then be moved a short distance to seal the opening, and remain in this position after sale. User access could be through a straw inserted into the passageways 26.

An issue that could arise with a commercial drink package that is made from a soft material or used by children, for example, is inadvertent squirting of the contents upon pressure being applied to the sides of the bags. In the bags of Figs. 12 and 13 it can be appreciated that the valves 80 used would preferably be configured to permit fluid flow out of the bag interior 14. Such valves could be further configured to maintain a closed state up to a predetermined threshold of pressure. This pressure level could be set, for example, to be higher than that ordinarily experienced by a casual squeezing of the bag. Preferably, the pressure threshold could be set to require a minimum degree of suction, either alone or in combination with some squeezing of the sides of the bag. In this way, inadvertent squirting of the bag contents could be reduced or avoided. Further, the passageway can be sized to permit only a limited amount of flow to prevent a sudden splurge of liquid.

In yet another embodiment, a bag 10 could be made with a slider having two joining edges 48. The bag opening 16 would then always be closed on both sides of the slider 20. In a further variation, the slider could have the passageway 26 without a valve 80, so that the passageway is always open. The panes 30 and 32 could be sealed together below the slider 20 at every point except a small portion. Therefore, the bag 10 would be sealed for every position of the slider 20 except where the slider is positioned so that the passageway 26 is immediately above the open portion. The positioning of the slider would function as a valve in this embodiment, to open or close the passageway. In production the slider could be positioned first over the open portion to receive a nozzle into the passageway, to fill the bag with a drinkable fluid, for example. The slider could then be pushed to a side, to seal the contents during transport and storage. Upon purchase, the consumer would move the slider to the access position and insert a straw to drink the contents.

It will be appreciated by those skilled in the art that the foregoing description was in respect of preferred embodiments and that various alterations and modifications are possible within the broad scope of the

appended claims without departing from the spirit of the invention. For example, while reference is made to a bag having one or two bodies, more bodies may also be used in a single bag where the application merits. Various other modifications will be apparent to those skilled in the art but are not described in any further detail herein.